LAT 41.04539 LON -121.35671 63.05

Detection (Disease)

5220
March 18, 1963

ROOT DISEASE SURVEY
COLUMBUS DAY 1962 BLOWDOWN AREAS

INTRODUCTION

The wind storm that occurred October 12, 1962 blew down varying numbers of living trees in numerous forest areas throughout Northern California. In areas of an occasional down tree the question arises "Was the loss due to defective roots?" In areas of complete blowdown the question arises "What percentage of the trees had detectable root diseases?" To answer these and other questions a survey of the blowdown is to be made during the spring of 1963. Data to be recorded and methods of making the survey have been worked out with members of Forest Disease Research at the Pacific Southwest Forest and Range Experiment Station.

PURPOSE

The purpose of the root disease survey will be as follows:

1. To determine the percentage of blowdown trees having their root system weakened by a disease in areas of light damage.

2. To determine the percentage of trees having root diseases for areas of heavy blowdown.

3. To increase our knowledge of the range and prevalence of the various root fungi by plotting each infection center (by type of disease or rot present) on a map.

METHOD OF SELECTING AREAS

The purpose of this survey is best served by directing the sampling to known areas of blowdown. Also, the scope of the work will be limited by funds and the availability of technical personnel. For these reasons it will not be feasible to select study areas by random methods that will permit evaluation of data by predetermined confidence levels.

Areas to be sampled are confined to the Lassen, Modoc, Shasta-Trinity, and Klamath; the Forests encompassing the greatest damage. To increase the number of trees that can be examined under these conditions, the survey is being restricted to areas readily accessible by road. An effort will be made to space the plots so as to sample different timber types in each of the broad areas of each forest. The plot areas will be selected after conferring with Forest personnel.

METHODS OF WORK

Two different procedures will be followed in collecting data--one designed for areas of heavy blowdown and the other for areas involving single-tree or small-group blowdown.

1. Heavy blowdown areas. A plot in heavy blowdown usually will consist of 100 trees. These will be examined by starting adjacent to the access road of the blowdown area and running a strip one-half-chain-wide across the opening or until the roots of 100 trees (or other predesignated number) have been examined. Trees along the strip are to be examined as they are encountered. The predesignated azimuth will be followed by compass and the distance determined by pacing. Each tree will be examined to determine whether dead or diseased roots were present when it blew down. When such roots are found, an effort will be made to determine the cause of death--if this cannot be done on the ground a sample will be collected for laboratory determination. Trees for each plot will be numbered consecutively.

2. Light blowdown areas. A predesignated area determined by a measured distance along a road, a drainage, a ridge top, etc., will be set up as a light blowdown plot. The data for each plot will be kept separately and trees for each plot area will be numbered consecutively regardless of whether they occur individually or in groups. When taking a plot in light blowdown each tree found will be examined, regardless of location or side of road.

PLOT PROCEDURE

Except for the "total trees" (which cannot be entered until the plot is finished) the headings on the survey data sheet should be completed before any work is done.

Data will be recorded in code using the same number of digits as there are "X's" in the column heading--for example, "Forest" has two X's so the Klamath would be noted as 05, the Lassen as 06, Modoc 09, and Shasta 13. The Mendocino, where procedures are to be tested, is 08.

Standard County codes will be used as follows: Glenn 11, Lassen 18, Modoc 25, Plumas 32, Shasta 45, Siskiyou 47, Tehama 52, and Trinity 53.

Site will be determined for all complete blowdown areas and a general one for the scattered areas. Site codes are: A-200 - 0, 175 - 1, 150 - 2, 125 - 3, 100 - 4, and 75 - 5.

Total trees will be the number examined on a plot and will require a three-digit number.

Elevations are to be recorded to the nearest 100 feet. A two-digit number will be used as 01 for 100 feet, 02 for 200 feet, 23 for 2,300 feet, and up to 99 for 9,900 and over.

Type of blowdown means whether it is scattered code 1 or concentrated code 2.

Stand Treatment refers to whether or not the area has been cutover. Uncut is code 1 and cutover code 2.

The year the area was cut will be recorded as a two-digit number as 54 for 1954, etc.

Plots will be numbered consecutively for each forest. A two-digit number will be used for numbering plots.

The name of the plot will be inserted and the township, range, and section will be recorded.

The date will be entered and the names of the crew will be noted.

A three-digit figure will be used for numbering the trees--for example--tree number-one will be recorded 001, tree ten as 010, etc.

The standard code for tree species will be used, a set of which will be available to carry with the forms in the binder. The common trees and their codes are: Douglas-fir 01, redwood 05, ponderosa pine 11, Jeffrey pine 12, sugar pine 13, western white pine 14, lodgepole pine 15, white fir 31, red fir 32, and incense-cedar 51.

Diameter will be recorded to the nearest 2-inch interval.

Aspect covers the direction of slope and the codes are: Level 0, north 1, northeast 2, east 3, southeast 4, south 5, southwest 6, west 7, and northwest 8.

Slope is divided into two columns, the first covering topographic characteristics--the codes and descriptions are: Ridgetop 1, sidehill 2, canyon bottom and draw 3, dry flat 4, wet flat 5, and other 6. The second column will cover percent of slope, which is the actual percent read on an Abney hand level and is recorded as two digits: 08, 24, etc.

Soil texture is used to note whether the soil is loose 1, (sandy, volcanic ash, etc.), moderate 2 (loam), or compact 3 (clay).

Presence or absence of basal wounds are noted. The cause of any wounds should be determined if possible. The codes and descriptions for basal wounds follow: none 0, fire scar 1, lightning scar 2, falling tree 3, logging 4, porcupine 5, insects 6, bear damage 7, unclassified 9.

The column for recording the presence of root rot is divided into two parts titled 1st and 2nd. This is to take care of two root diseases should two be found on the roots of a single tree. The code for the various root diseases which might be found are: none 0, Polyporus schweinitzii 1,

Armillaria mellea 2, Fomes annosus 3, Verticicladiella wageneriì 4, Poria weirii 5, and unclassified 9.

The column titled "Identifying Criteria" will be divided into two parts to take care of two diseases that might occur on the roots of a single tree. These parts are labeled 1st and 2nd. A three-digit figure will be used to record the identifying criteria; one digit for each of three criteria. The codes identifying criteria must be used only for their respective root disease; for example, the criteria for Fomes annosus must be used for this disease only.

Infected roots will be divided into two sizes--large (buttress type, tap, and large laterals) and small (all others). When both size classes are diseased an effort will be made to determine which size-class supported the initial infection. The codes for recording this information are: no disease 0, small roots only 1, large roots only 2, both sizes infected but initial infection on small roots 3, both sizes infected with initial infection on big roots 4, and both sizes infected but unable to determine which size class first infected 5.

The percentage of the visible roots that are affected by root rot will be estimated. The actual estimate will be recorded as a two-digit figure.

Tree position is used to differentiate between individual tree (including groups up to 3) and group blowdown. For individual trees use code 1 and trees in Groups (over 3) code 2.

The distance to the nearest stump or to the nearest windthrown tree that was on the ground before October 12, 1962 will be recorded up to 99 feet. Trees and stumps beyond this distance will be ignored as they have little if any influence on spreading root diseases. Two-digit numbers will be used with 00 when no stump or old windfall is within 100 feet.

The number of trees that have died within the last 5 years in the immediate vicinity of a windthrown tree will be recorded by the following three size classes: 0 to 6 feet in height, 6.1 feet high to 11 inches diameter breast high, and 11+ inches d.b.h. A two-digit number will be used to record each of these 00 being used for none, 01 for one, etc.

SURVEY CREW

The survey crew will consist of two men, a pathologist from the Regional Office who will work as long as the survey is being conducted and a recorder who will be assigned by the forest on which the work is being done for the duration of the survey on that forest. The pathologist will plan the work, locate plots, etc. He will examine the roots of the selected trees and call off the data. The recorder will record the data in code as it is given to him. When strips are run, the recorder will act as compassman and do the pacing in addition to his other duties.

Identifying Criteria

A. Fomes annosus

1. Thin tissue-paper-like mycelium felts, not noticeably veined, form between the bark and wood and between bark scales.

2. Small dirty-white outgrowths occur on the underside of the roots.

3. In the incipient stage, decayed wood is pinkish to dull-violet color.

4. In the advanced stage, the wood shows small elongated pockets sometimes with black spots or flecks in the center, the pockets being separated by areas of firm brownish wood.

5. The pockets finally run together, forming a mass of spongy or stringy white fibers flecked with black.

6. Heavy resin flow and impregnation of root tissue with resin at point of infection.

7. Perennial sporophores if found are small, usually under ground on root collar, have a biscuit colored under-surface with small pores and usually with a lighter-colored sterile margin. The upper surface is zoned and of a light to grayish-brown color. The pileus more or less encrusted shows a dark thin line at the crust when sliced vertically. The conk is difficult to tear because of its rubbery or leathery context.

   Ridges of reddish-brown, nonspore-bearing tissue surrounding holes formed by the growth of the conk around grass, sticks, and other objects are useful in identifying the conks.

8. Peeled bark from dead, dry roots shows a silvery film with brown longitudinal striations in the cambium layer of both the bark and wood.

9. A reduction in length of youngest needles by half or more occurs a year or so before the tree dies. The disease tends to kill trees in groups.

B. Armillaria mellea

1. The presence of rhizomorphs positively identifies this root rot. Rhizomorphs are branched strands of mycelium, of dark brownish to shiny black color, 1/25- to 1/12-inch in diameter and are often flattened when they develop beneath the bark.

2. The fruiting structure is a mushroom with a smooth cap, honey-colored to brownish, yellowish gills extending down the stem on the underside, generally grows in clusters near the base of the tree. The solid stems join other stems of the cluster at the

slightly swollen base. Usually the remnant of a vein is still attached to the upper stem.

3. Mycelial fans between the wood and bark are typical of this fungus. Usually the fans have veins running radially from the base of the fan to the outer edges. Fans of mycelium may also be found in cracks and under scales in the bark. The mycelial growth (in cambium or elsewhere) generally is in thicker "felts" than that found in F. annosus.

4. In conifers particularly pines, there is commonly an abnormal resin flow from the root collar, sometimes so great that the litter and soil is compacted into a hard crust. It is in decayed wood and bark in this area where mycelial fans are most frequently found.

5. Infected wood first shows water-soak and later an indistinct, broad to narrow, purplish to brownish invasion zone which borders the last stage of decay. Surrounding the whitish to yellowish areas of decay or embedded in them are dark brown to black, narrow thread-like zone lines, at times concentric, which form below the surfaces of the infected wood at points where rapid drying has occurred. In the advanced stage of rot the wood becomes light yellow or white in color, soft and spongy, often stringy in conifers and marked by numerous black zone lines.

C. Polyporus schweinitzii

1. The annual conks may be found on the base of infected trees but more frequently on roots or in the duff over an infected root. They may appear as a thin bracket on a tree but on the ground they look more like a mushroom, being circular in shape and sunken in the center tapering to a short thick stalk. When fresh, the upper surface is velvety, concentrically zoned and reddish-brown in color with a light yellow-brown margin.

2. Incipient decay cannot be detected. In the advanced stage the wood is yellow-brown to red-brown in color, brittle, breaks into large cubes on drying and can be easily crumbled into a fine powder. Rot is confined to heartwood of bole and roots.

3. Thin, crustlike layers of mycelium that are easily mistaken for resinous crusts are formed in the shrinkage cracks.

4. The rot has a turpentine or anise-oil odor.

D. Verticicladiella wageneriI

1. Dark stain in basal sapwood and roots penetrating the wood from .3 to 3.0 inches in a few months.

2. The stain does not follow a wedge-shaped pattern but tends to follow the annual rings and apparently does not invade the medullary rays.

3. Color may range from an intense black through dull or grayish black to brown or purplish brown.

4. Trees show a marked growth reduction at least one year before death occurs.

5. Has been found on ponderosa, Jeffrey, and pinyon pine in California. Has been found to stain a streak of sapwood (ponderosa) 7 feet above the ground. Usually the stained wood is confined to the roots and root collar and only rarely does it stain the sapwood above ground level.

E. Poria weirii

1. Kills trees in groups--the first indication of the disease is a reduction in growth, a gradual thinning of the foliage which is usually accompanied by a crop of smaller than normal cones.

2. Incipient stage of decay appears on the face of the stump as a brownish stain, crescent-shaped to irregular in outline, mostly in the heartwood.

3. Advanced decay is soft and flaky, yellowish to brownish, and honeycombed with small pockets, at first filled with whitish fibers, later empty.

4. Brown mycelial felts are present in the cambium and on the surface of bark on decayed roots. Frequently a small patch or a thin web of dark brown hyphal strands develop between the annual rings and the wood shows long striations or thin, closely packed pockets.

5. Decayed wood separates readily along the growth rings.

6. The perennial sporophores are resupinate (flat) layered, pored structures found in root crotches of dead trees or on the underside of infected logs. At first they are light buff in color with a white margin. Later they turn a uniform brown color. The context of the conk is dark brown where fresh. (This disease has never been reported in California. It is a serious root disease on Douglas-fir and associated species in Washington, British Columbia, and northern Oregon and has been found on Douglas-fir as far south as the Rogue River National Forest in southern Oregon. If Douglas-fir blowdown is examined on the Klamath National Forest, field personnel should keep a careful watch for this disease.)

Enclosure (form)

Branch of Pest Control
Division of Timber Management
U. S. FOREST SERVICE
630 Sansome Street
San Francisco 11, California

ROOT DISEASE SURVEY
COLUMBUS DAY BLOWDOWN 1962

Forest _____ xx ____ Total Trees _____ xxx ____ Stand Treatment _____ x ____
County _____ xx ____ Elevation _____ xx ____ Year of CO _____ xx ____
Site _____ x ____ Type of Blowdown _____ x ____ Plot No. _____ xx ____
T ____ R ____ S ____ Data by _____
Date _____ Notes by _____
Name of Plot _____

Tree Number	Species	Diameter	Aspect	Slope: Topog. Char.	Slope: Percent	Soil Texture	Basal Wounds	Disease Data: Root Rots Present 1st	Root Rots Present 2nd	Identifying Criteria 1st	Identifying Criteria 2nd	Percent Roots Damaged	Size of Root Infected	Tree Position Single/Group	No. Trees Killed in Immediate Vicinity: 0-6'	No. Trees Killed in Immediate Vicinity: 6.1'-11'	No. Trees Killed in Immediate Vicinity: 11'+	Distance to Nearest Stump
XXX	XXX	XXX	X	X	X	X	XX	X	X	XXX	XXX	XX	X	X	XX	XX	XX	XX